Table 2. PRODUCTS REQUIRED BY END USERS (5/31/04)

Hazard	Information/ products needed for crisis response (during and after)	Information/ products needed for hazard mitigation (between)
Wildland and urban-interface fire	Clear, authoritative maps of fire perimeter, areas at risk for response planning, generated overnight for use the next day Timely alerts and updates to government officials, the affected population, and the media on fire location and status, effects on roads, possible evacuation routes Documentation of burned area, intensity of damage to vegetation and soils, at the watershed scale	Information on vegetation health, fuel loading, fire history. Needed for planning controlled burns, anticipating future fire activity.
Earthquakes	Clear, authoritative information on the location and magnitude of the shock and the time frame (in days) of aftershocks. Timely updates are critical for activating shutdown of critical facilities (power plants, trains, etc.) Post-event maps (shake maps, damaged/affected areas, identification of safe areas) also needed.	Hazard zonation maps: paper maps or GIS data bases showing areas of lower vs. higher intensity of ground motions. Maps for various secondary effects of seismic hazards (landslides, liquefaction, etc.) are also needed.
Volcanoes, volcanic ash and aerosols	Clear, authoritative information on most likely course of the unrest/eruption, whether ash explosions may occur. Includes best estimates on when and what type of eruption, possible size, which areas or air routes will be affected and which will be safe. Timely updates are critical.	Need hazard zonation maps: paper maps or GIS data bases showing areas of lower vs. higher risk, for future eruptions. The maps for various major hazards (lava flows, lahars, ash fall, etc.) will be different.
Landslides	Local, rapid mapping of affected areas, magnitude of instability, updated scenarios during ongoing instability, impact analysis. Early warning of heightened risk, if heavy rainfall is forecast for areas of known high hazard of landslides and debris flows	Regularly updated susceptibility and hazard zonation maps for landslides, debris flows, rock falls, subsidence (at appropriate scales).

Floods	Timely and accurate short through extended range forecasts and warnings which quantify certainty and convey risk (time, discharge, stage, area inundated) for both river and flash flood events Ground surveys, aerial photos and interviews for damage assessments	Flood hazard zonation maps, including accurate topographic maps; mapping of land use and land use changes; flood history of the area
Extreme weather	Timely and accurate forecasts (time, location, intensity and nature of severe weather). Accurate and comprehensive real-time data during the event (e.g. location of strong winds, heavy precipitation, hail and direction of propagation). GIS mapping, ground surveys, interviews, aerial photos for damage assessments.	Historical data for the area (e.g. frequency of tornadoes, strong winds, heavy snows, hail) Needed for input to land use planning, building standards, such as wind resistance, roof loading, materials resistant to hail, and tornado safe rooms.
Tropical cyclones	Timely and accurate landfall analyses in real time and forecasts (timing, location, intensity, outer wind radii, storm surge, sea state, rain quantity) GIS mapping , aerial photos for damage assessments.	Historical track and intensity information to generate hazard zonation maps. Input to building standards for wind resistance and protection against storm surge. Land use policy in coastal areas, especially low-lying areas
Sea and lake ice	Timely and accurate real time ice analyses and forecasts – short (days), medium (weeks), utilizing high-resolution imagery Charts in GIS and graphic format Meteorological model output (cloud cover, precipitation, snow cover, winds, temperature)	Seasonal ice analysis and forecasts (months, years) Charts in GIS and graphic formats Ice climatology (ice extents, probability of occurrence, presence of old ice, ice of land origin)

Coastal hazards, tsunami	Accurate information regarding the presence of tsunami, time of arrival, duration of event (all clear signal); boundaries of inundation area; evacuation routes. Post-event surveys to measure extent and height of inundation to validate/improve forecast models and inundation maps.	Inundation hazard maps for emergency response and land use planning; maps require 100% coverage bathymetric surveys from ships and/or LIDAR (from shoreline to the continental shelf break); accurate topographic information in the potential run-up area (heights to 25 meters above sea level) Regularly updated high-resolution shoreline maps and dune erosion rate maps needed for mitigation policy such as establishing setback lines
Pollution events	Clear, authoritative information on the location, compound(s) or chemical(s) released, magnitude of the technological release and the media in which the release occurred (air, land and/or water). GIS information to support public notifications. Timely updates are critical for activating shutdown of potentially affected facilities (water treatment plants, transportation networks, etc.) Post-event maps (release maps showing damaged/affected areas, identification of safe areas) Death and injury counts and locations.	Accurate topographic maps; GIS mapping of land use and land use changes, (possibly based on aerial photos)
Space weather	Clear, authoritiative information on the timing and magnitude of solar X-ray flares, solar energetic particle events, and geomagnetic storms Timely updates are critical for commercial airlines flying polar routes, all satellite operators (civil, military, or commercial) and electrical power companies Post-event summaries to allow affected technologies and services to return to normal operating modes	Maps showing areas of the Earth affected by particles, X-ray photons, and electrojet currents for use in configuring systems and operations vulnerable to space weather. These include satellites, electronic navigation systems and electric power grids.